

REMARKS

The Examiner is thanked for the thorough examination of the present application, and the continued indication that claim 41 contains allowable subject matter. The FINAL Office Action, however, continued to reject all remaining claims.

Claims 1-2, 4-6, 8-16, and 18-41 remain in this application. Claims 42-52 have been added. Specifically, Applicant has added claims 42-47 to define certain novel and non-obvious features of inventive embodiments. Specifically, claim 42 recites (among other features) the limitation of “wherein the first etch stop layer is a SiCO film, and the second etch stop layer is a SiN film.” Support for this limitation can be found at least on page 14, lines 3-5 of the application. Accordingly, the amendment adds no new matter to this application.

Applicant has also added new claims 48-52, which also define certain novel and non-obvious features of inventive embodiments. Specifically, claim 48 recites the limitation “wherein the first etch stop layer is a SiCO film, and the second etch stop layer is a SiCO film”. Support for this limitation can be found on page 14, lines 3-5 of the application. Applicant submits that no new matter has been added.

35 U.S.C. 103(a)

Claims 1, 6, 7, 11, 13-15, 20, 21, 26, 28, 29, 33, 34, 38, and 40 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Bao et al. (US 6,455,417) in view of Chow (US 6,674,146). Claims 2, 16, and 30 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Bao et al. and Chow in view of Campana et al. (US 6,537,733). Claims 4, 18, and 31 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Bao et al. and Chow in view of Wong (US 20030224593). Claim 5, 19, and 32 stand rejected under 35 U.S.C. 103(a)

as allegedly unpatentable over Bao et al. and Chow in view of Lu et al. (US 20020100693). Claims 8, 9, 12, 22-24, 27, 35, and 39 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Bao et al. and Chow in view of Li et al. (US 6,753,260). Claims 10, 25, and 37 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Bao et al. and Chow in view of Kloster et al. (US 20020140103). Applicant respectfully traverses the rejections for at least the reasons discussed below.

First, none of the cited references, alone or in combination, properly teach or suggest the features of “the etch stop layer has a dielectric constant smaller than 3.5”, “the dielectric layer has a dielectric constant smaller than 3.0”, and “the dielectric layer has a tensile stress approximating to the compressive stress of the etch stop layer”, achieving diminishing the stress difference therebetween (see page 6, lines 15-18 of the application). The Office Action acknowledged that Bao et al. do not teach that the dielectric layer has a tensile stress approximating to the compressive stress of the etch stop layer. Further, the Office Action asserts “the Chow reference suggests the use of a material having high compressive stress with a material having high tensile stress”, “furthermore, Chow discloses that the use of dielectric layers made to having approximate compressive and tensile stresses will minimize the effect of tensile stresses (see Column 2 Line 65 of the Chow Reference)”, and “hence, the suggestion to modify the Bao reference is present in Chow” in the Final Office Action mailed in 04/25/2006.

In contrast to the claimed embodiments, Chow discloses the barrier layer 130 (corresponding to the etch stop layer of the claimed invention) is cubic boron nitride (CBN) having a dielectric constant of 4-4.5 (Column 2 Lines 55-57). As is known, cubic boron nitride is a relatively high compressive stress material allowing, in one example, its use *in conjunction with* high tensile stress materials to minimize the effect of the tensile stress. Chow, however,

fails to disclose the feature of “*the dielectric layer has a tensile stress* approximating to the compressive stress of the etch stop layer”, achieving diminishing the stress difference therebetween of the claimed invention.

In order for the PTO to properly establish a *prima facie* case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teaching. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. See MPEP 2142. These criteria have not been met with respect to the present rejection.

First, Chow discloses that cubic boron nitride is a relatively high compressive stress material allowing, in one example, its use *in conjunction with* high tensile stress materials to minimize the effect of the tensile stress, but the claimed invention discloses the dielectric layer (having tensile stress) formed overlying the etch stop layer (having compressive stress). Chow, however, discloses only a vague concept that high compressive stress material *in conjunction with* high tensile stress materials to minimize the effect of the tensile stress. The result of stress diminishing from the dielectric layer (having tensile stress) formed *overlying* the etch stop layer (having compressive stress) of the claimed embodiments is clearly not contemplated in the combination of Bao et al. and Chow (even assuming that the two references can be properly combined).

Second, Chow *fails to* disclose the dielectric layers 140 and 280 having tensile stress, and thus, Chow clearly *fails to* disclose “*the dielectric layer has a tensile stress* approximating to the compressive stress of the etch stop layer”, achieving diminishing the stress difference

therebetween of the claimed embodiments. In fact, Chow does not disclose the stress properties of the dielectric layers 140 and 280, and mutual stress relationship between barrier layers 130, 230 and dielectric layers 140, 280 all over the specification. Thus, the result from “*the dielectric layer has a tensile stress approximating to* the compressive stress of the etch stop layer”, achieving diminishing the stress difference therebetween of the claimed invention is clearly not contemplated or foreseen in the combination of Bao et al. and Chow.

Third, Chow introduces cubic boron nitride acting as barrier layers in order to reduce the effective dielectric constant of a composite dielectric layer having a barrier layer and a dielectric layer. See Chow reference in Column 3 Lines 21-24 and Column 5. Further, Chow *fails to* disclose the *stress properties* of the dielectric layers, and *mutual stress relationship* between barrier layers and dielectric layers. There is no motivation for one of ordinary skill in the art to combine the teachings of Chow into the teachings of Bao et al. to achieve the stress diminishing from “*the dielectric layer has a tensile stress approximating to* the compressive stress of the etch stop layer” of the claimed invention.

Further still, Chow discloses the dielectric layer 140, may be an aerogel, overlying the the barrier layer 130 (corresponding to the etch stop layer of the claimed invention), which is cubic boron nitride (CBN) having a dielectric constant of 4-4.5. Chow does not teach a layer material with high compressive stress can be used with other layer materials having high tensile stress when “the etch stop layer has a dielectric constant smaller than 3.5” and “the dielectric layer has a dielectric constant smaller than 3.0”. Thus, even if the disclosures of Bao et al. and Chow are properly combined, *the result of stress diminishing* from the dielectric layer (having tensile stress) formed *overlying* the etch stop layer (having compressive stress), in which “the dielectric layer has a *dielectric constant smaller than 3.0*” and “the etch stop layer has a

dielectric constant smaller than 3.5” of the claimed invention is not contemplated or disclosed from Bao et al. and Chow.

For at least the foregoing reasons, Applicant submits that the Examiner has failed to satisfy these criteria in asserting that the rejected claims are obvious in view of Chow combined with Bao et al.

As neither of the citations, when taken alone or in combination, teaches or suggests “the dielectric layer, having a dielectric constant smaller than 3.0, has a tensile stress approximating to the compressive stress of the etch stop layer, having a dielectric constant smaller than 3.5” of claims 1, 14, and 29, these are allowable over the cited references. Insofar as claims 2 and 4-13, 15-16 and 18-28, and 30-41 depend from claims 1, 14, and 29, these claims are also allowable.

New Claims

Claim 42 is newly added to emphasize a limitation that the first etch stop layer is a SiCO film, and the second etch stop layer is a SiN film. There is no cited prior art disclosing such a limitation and achieving such an unexpected result. Therefore, claim 42 should be allowable. Insofar as claims 43-47 depend from claim 42, these claims are also allowable.

Claim 48 is newly added to emphasize a limitation that the first etch stop layer is a SiCO film, and the second etch stop layer is a SiCO film, wherein a first etching selectivity S_1 of the first etch stop layer to the dielectric layer, and a second etching selectivity S_2 of the second etch stop layer to the dielectric layer satisfy the formula: $S_1 \neq S_2$. There is no cited prior art disclosing such a limitation and achieving such an unexpected result. Therefore, claim 48 should be allowable. Insofar as claims 49-52 depend from claim 48, these claims are also allowable.

As a separate and independent basis for the patentability of claims 1, 14, and 29, Applicant respectfully traverses the rejections as failing to identify a proper basis for combining the cited references. In combining these references, the Office Action stated only that the combination would have been obvious “in order to minimize the effect of the tensile stress.” (Office Action, page 3). This alleged motivation is clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

"The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(*Emphasis added.*) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references,

the prior art must properly suggest the desirability of combining the particular elements to derive a copper interconnect, as claimed by the Applicant.

When an obviousness determination is based on multiple prior art references, there must be a showing of some “teaching, suggestion, or reason” to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the “absence of such a suggestion to combine is dispositive in an obviousness determination”).

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembiczak, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be “clear and particular.” Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 (“The absence of such a suggestion to combine is dispositive in an obviousness determination.”).

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000).

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, the rejections of claims 1, 14, and 29 should be withdrawn.

Insofar as claims 2 and 4-13, 15-16 and 18-28, and 30-40 depend from claims 1, 14, and 29, these claims are also allowable for at least the same reasons.

CONCLUSION

In light of the foregoing amendments and for at least the reasons set forth above, Applicant respectfully submits that all objections and/or rejections have been traversed, rendered moot, and/or accommodated, and that the now pending claims 1-2 and 4-41 are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned agent at (770) 933-9500.

A credit card authorization has been provided to cover the charges of the accompanying RCE application, as well as the additional claims presented in this submission. No addition fee is believed to be due in connection with this amendment and response to Office Action. If, however, any additional fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Daniel R. McClure", written in dark ink.

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